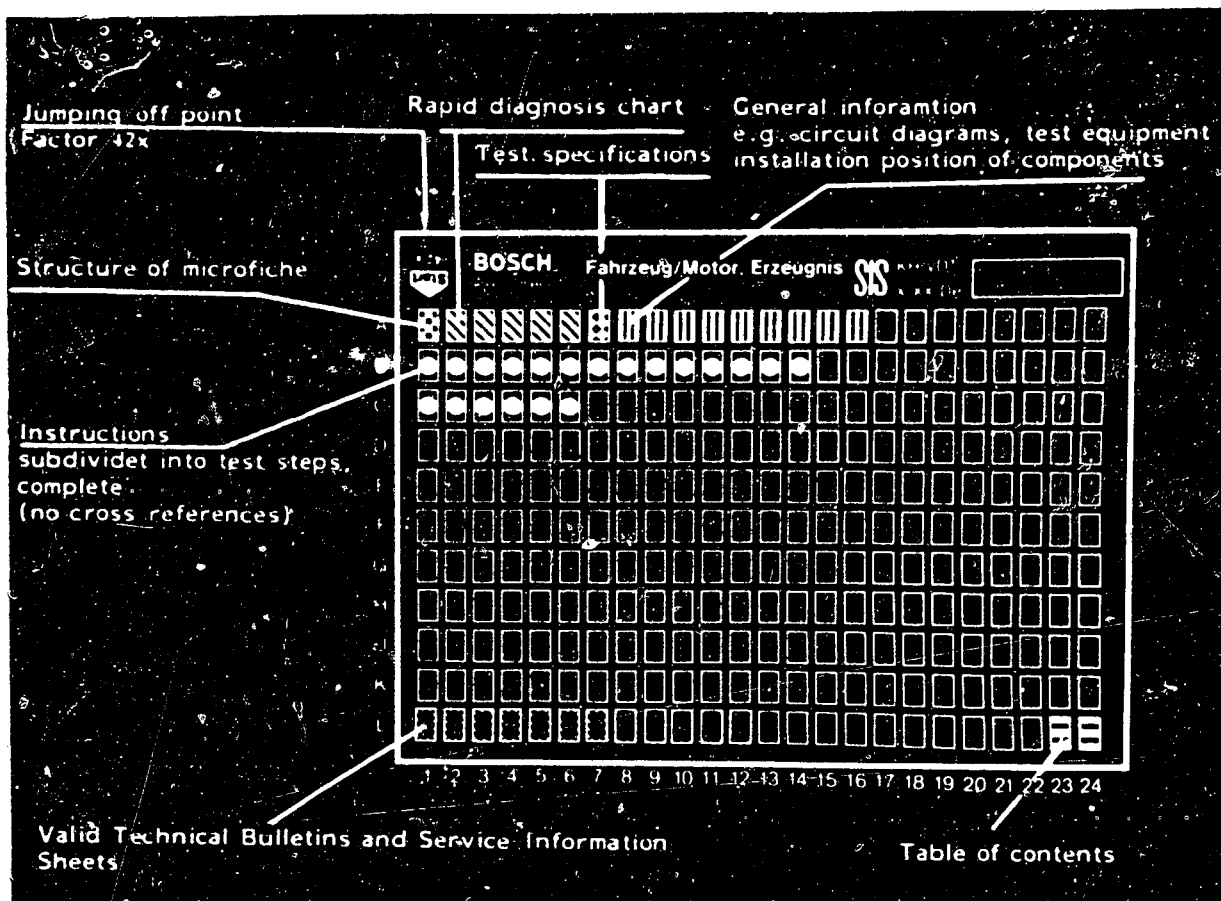


Structure of microfiche

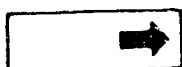


1. Read from left to right
2. Title of microfiche (appears on each coordinate)

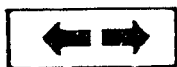
E 16	Product/assembly/test step	
	Vehicle/engine	

Coordinate

3. Limits of section



Beginning



Mid-section



End



One-page section

4. References to relevant test steps in test specifications; coordinate e.g. C6

C6

A1

Repair and testing



1. Rapid diagnosis chart

The following rapid diagnosis chart makes it possible for the experienced expert to quickly check the electrical/electronic part of the ignition system using normal workshop test equipment.

The rapid diagnosis chart contains the following information:

- Customer complaint
- Cause of the trouble
- Test instructions (if no coordinate given on the right, further possibilities for testing are indicated).
- Coordinates for detailed trouble-shooting.

If detailed information and instructions on trouble-shooting are necessary, always proceed according to the trouble-shooting program starting on coordinate B 1.



Rapid diagnosis chart

Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start

2. Rough idling

3. Poor throttle response

4. Engine lacks power

5. Misfiring

6. Fuel consumption too high

7. Engine pings when accelerating

8. Backfiring

9. Engine becomes too hot

									<u>Cause of trouble</u>	<u>Test instructions</u>	<u>Coordinates</u>
●	●	●	●	●	●		●		Spark plugs defective	Assess using ignition oscillograms or remove spark plug and make visual examination.	-
●	●	●	●	●	●	●	●	●	Ignition timing incorrect	See Autodata test specifications	-
●	●	●	●	●					Shunt on secondary side	Assess ignition coil, ignition distributor, ignition harness and spark plug using ignition oscillogram or make visual examination.	-
●	●	●	●	●					Open circuit on secondary side	Assess ignition coil, ignition distributor, ignition harness and spark plug using ignition oscillogram, or test for continuity using ohmmeter	-
●									Open circuit on primary side	Test voltage supply to trigger box or test primary circuit	C 3
●	●	●	●	●					Ignition coil defective	Make visual examination, electrical test	B 5

A3

Rapid diagnosis chart

BMW



A4

Rapid diagnosis chart

BMW



Rapid diagnosis chart

Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start
2. Rough idling
3. Poor throttle response
4. Engine lacks power
5. Misfiring
6. Fuel consumption too high
7. Engine pings when accelerating
8. Backfiring
9. Engine becomes too hot

									<u>Cause of trouble</u>	<u>Test instructions</u>	<u>Coordinates</u>
		•	•	•	•				Interference-suppression resistors defective	Assess using ignition oscillogram or perform resistance measurement	-
	•	•	•		•	•	•	•	Centrifugal advance defective	See Autodata test specifications	-
		•	•		•	•		•	Vacuum advance defective	See Autodata test specifications	-
•									Trigger box defective	Test trigger box output stage, test primary voltage	B 13 B 15
•									Ignition distributor pickup system defective	Pick-up resistance, pick-up winding short-circuit to ground, check pick-up system for mechanical damage.	C 1
•	•	•	•	•					Engine-speed limiter defective	Test cut-out speed, or perform visual examination.	
•									Firing sequence incorrect	See Autodata test specifications	

A5

Rapid diagnosis chart

BMW



A6

Rapid diagnosis chart

BMW



2. Test specifications

Ignition coil primary 0.3...0.6

B5

Ignition coil secondary 7.3...14.5 k

Series resistor 0.4 0.3...0.5

0.6 0.5...0.7

Voltage drop 1.7 V

Ignition coil with at U_B 11 V
ignition on

B7

Voltage supply max. 1.0 V

Trigger box with below U_B
ignition on

Dwell angle at

$n = 1500 \pm 50 \text{ min}^{-1}$ 33-51° (55-85%)

$n = 5000 \pm 50 \text{ min}^{-1}$ 45-55° (75-92%)

B11

Trigger box output stage
with ignition on

max. 2 V

B13

Primary voltage with
engine idling

100...180 V

B15

Resistance of coil
section

485...850 Ω

C1

Ground connection of
coil section

$R = \infty$

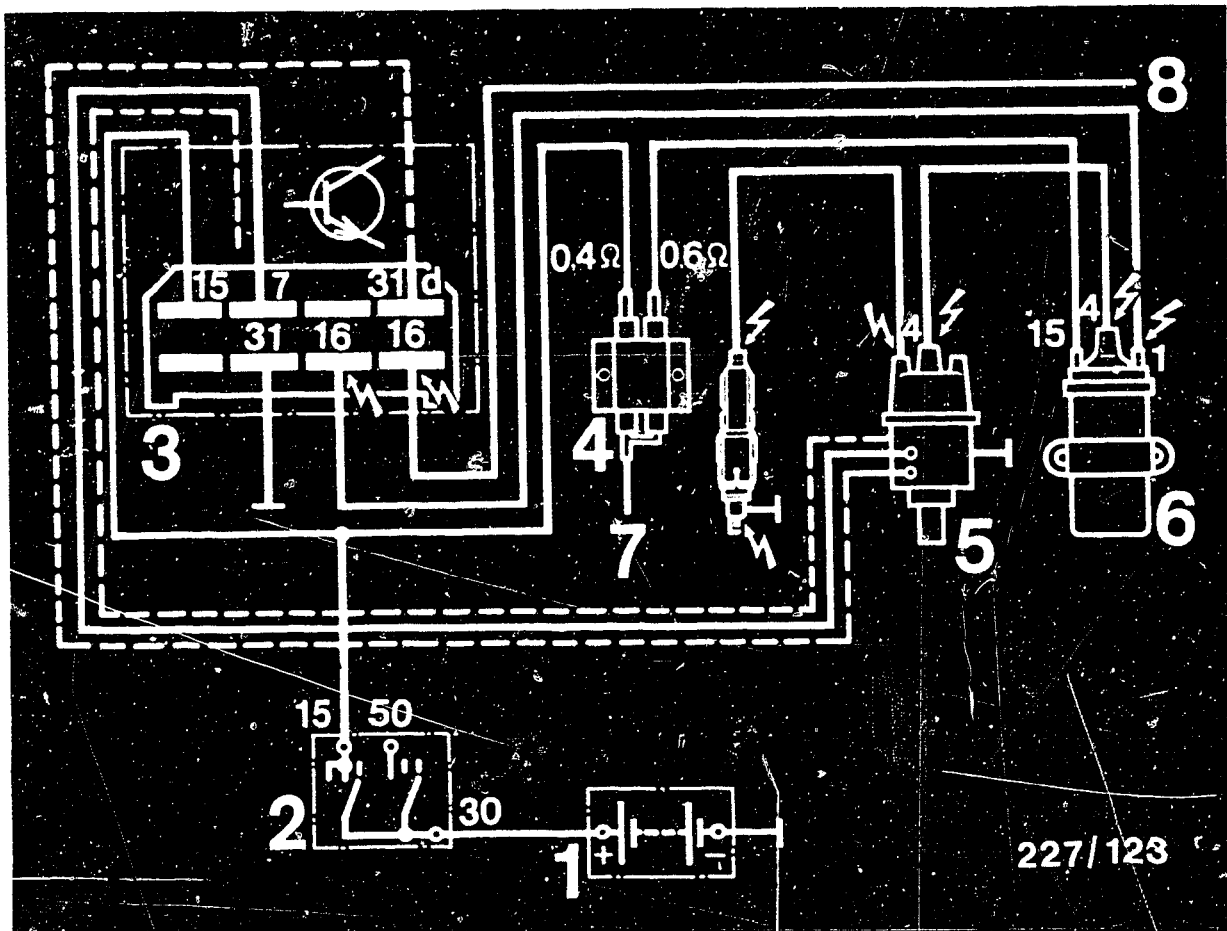
See Autodata test specifications for setting values for ignition, idle speed, exhaust gas, valve play etc.

A7

Test specifications

BMW

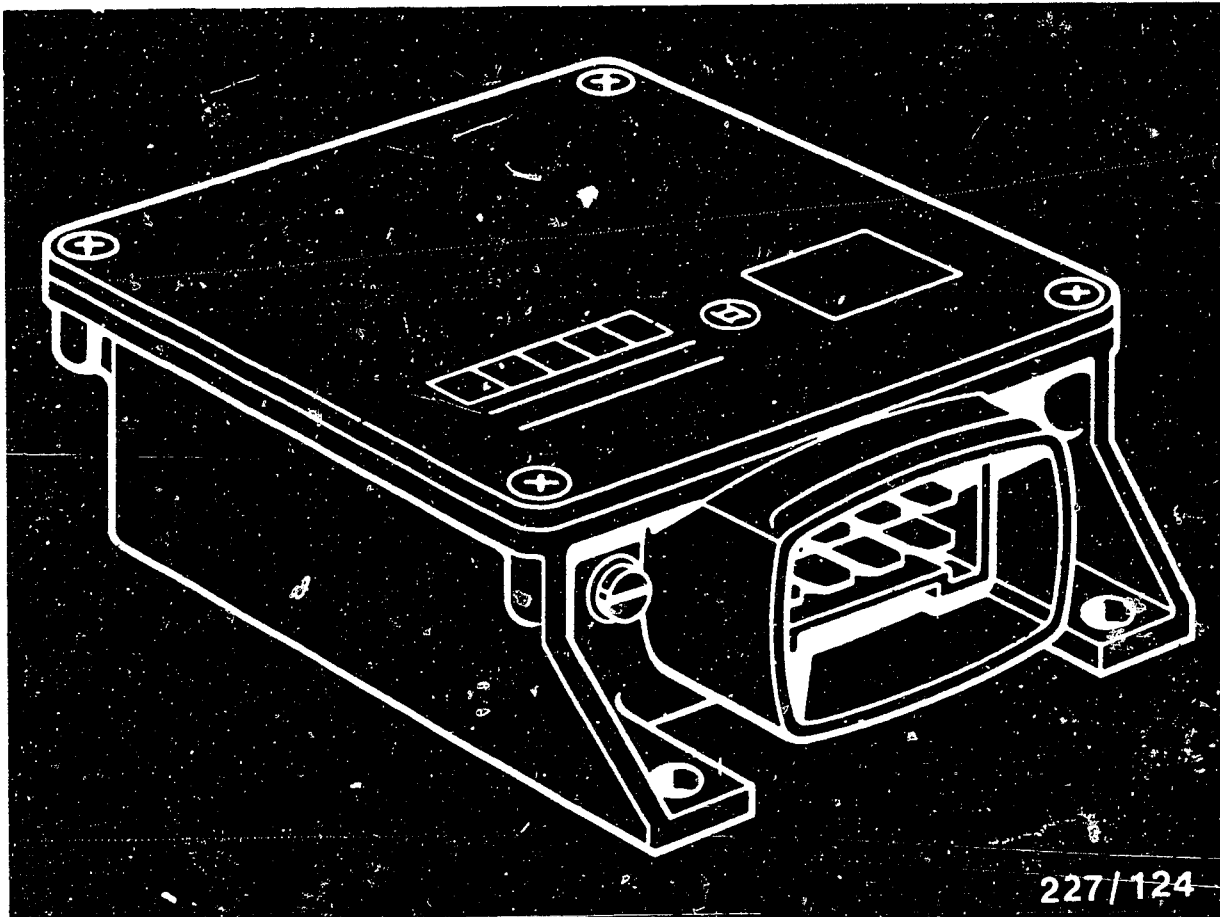




- | | |
|----------------------------------|---------------------------------|
| 1 = Battery | 5 = Ignition distributor |
| 2 = Ignition and starting switch | 6 = Ignition coil |
| 3 = Trigger box | 7 = To starting motor term. 15a |
| 4 = Ballast resistor | 8 = To L-Jetronic term. 1 |

⚡ = Dangerous voltages (400 V - 25 kV)

3. Electrical terminal diagram



TCI trigger box

4. Installation position of components

The trigger box is in the engine compartment.



5. Necessary test equipment and aids

Motortester e.g.	MOT 201	0 684 000 201
Spark gap e.g. ignition coil and condenser tester EFAW 106 A or single spark gap	EF 1177/7	0 681 100 001 1 684 531 000
5 k sleeve-type suppressor		0 356 500 001
Ohmmeter or e.g.	ETE 014.00 Pontavi Wh2	0 684 101 400 Commercially available
Voltmeter e.g.	ETE 014.00	0 684 101 400
Test prods		Commercially available



6. Danger of accident on electronic ignition systems

Increased demands of modern engines on the ignition system combined with the desire for freedom of maintenance have recently led to electronic ignition systems being fitted as standard. Usually the ignition power of electronic systems (of almost all manufacturers) is higher than that of conventional systems, and there are signs of further increases in power. Electronic ignition systems thus reach a power range which can be highly dangerous if live parts or terminals are touched (both on the primary as well as the secondary sides).

In this connection we should like to point out that the VDE regulations, in particular VDE 0104/7.67 and/or the respective national regulations must be followed when testing or working on the ignition system.

The ignition should always be switched off when working on the ignition system (switch off ignition or voltage source). Such work includes:

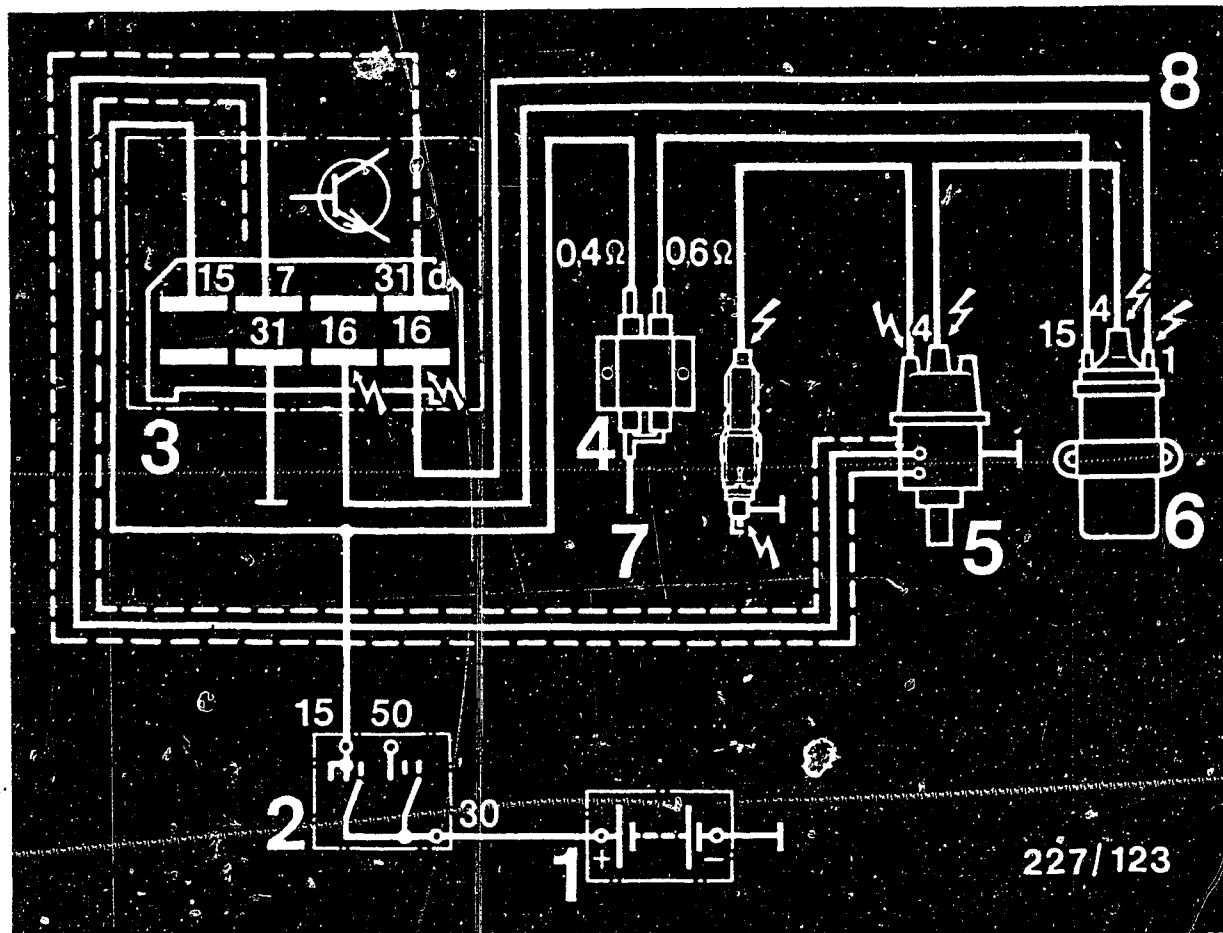
- Connecting of engine test equipment (timing light, dwell-tach tester, ignition oscilloscope, etc.).
- Replacing parts of the ignition system (spark plug, ignition coil, ignition distributor, H.T. ignition cable, etc.).



If, while testing the ignition system or during adjustment work on the engine (e.g. carburettor), it becomes necessary to switch on the ignition (switch on ignition or voltage source), the above-mentioned dangerous voltages occur over the entire system.

The danger of accident exists, therefore, not only on the individual assemblies of the ignition system (e.g. ignition distributor, ignition coil, trigger box, ignition harness), but also on the wiring harness (e.g. tachometer connection, diagnostic plug), at plug-in connections and test equipment.





- | | |
|----------------------------------|---------------------------------|
| 1 = Battery | 5 = Ignition distributor |
| 2 = Ignition and starting switch | 6 = Ignition coil |
| 3 = Trigger box | 7 = To starting motor term. 15a |
| 4 = Ballast resistor | 8 = To L-Jetronic term. 1 |

⚡ = Dangerous voltages (400 V - 25 kV)

Electrical terminal diagram

The dangerous locations are marked with danger arrows taking the example of the terminal diagram of an electronic ignition system.



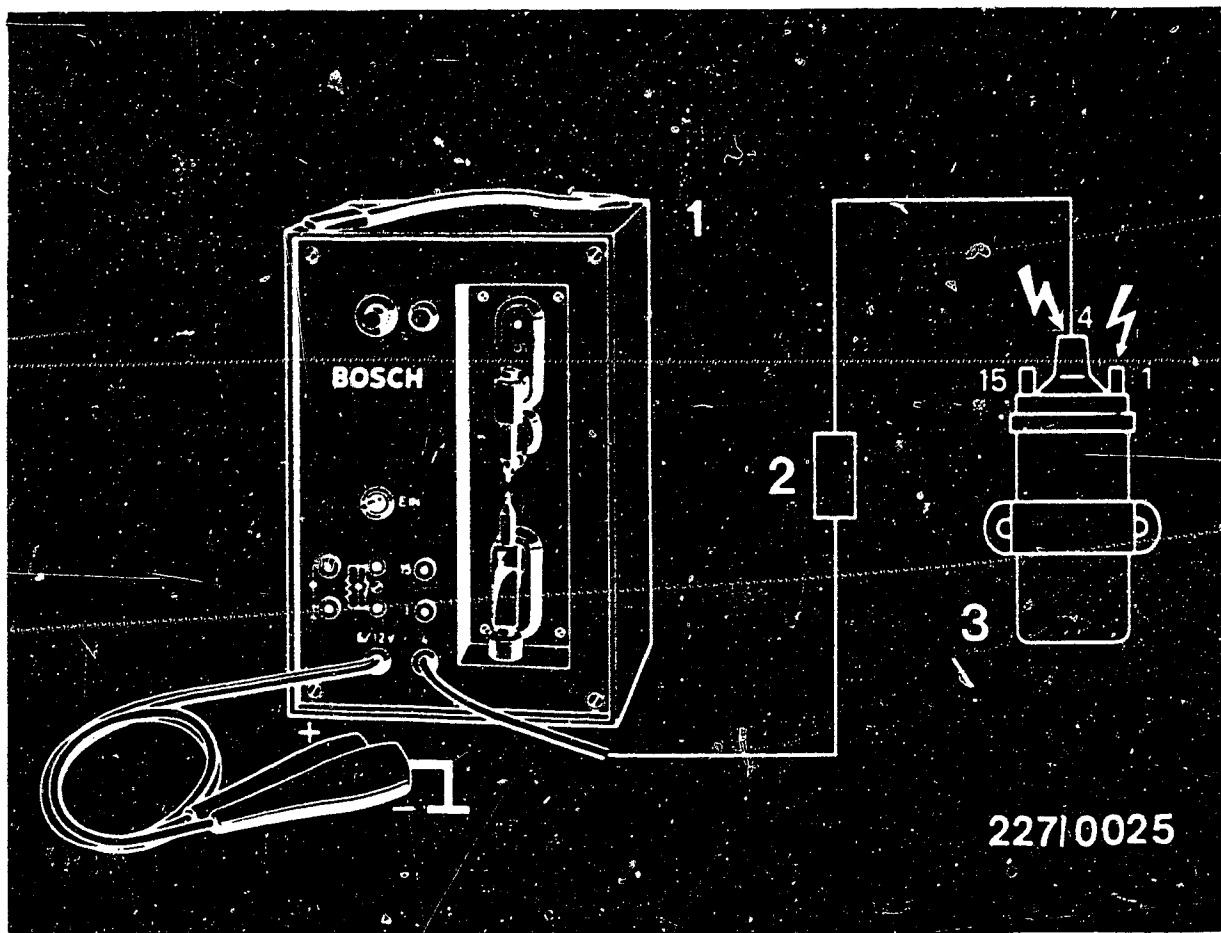
7. Important vehicle information

- During the compression test, either pull off the trigger-box plug or firmly connect terminal 4 of the ignition coil to ground using an extra cable (dangerous voltages, insulation damage at ignition coil, ignition distributor or ignition harness).


Note: The extra cable must be suppressed with at least 2 k Ω , e.g. with the interference suppression sleeve (5 k Ω) 0 356 500 001.

- Resistance measurements must only be performed with the ignition switched off or with the battery disconnected (measuring instrument defective).
- In order to prevent the trigger box from being irreparably damaged, the secondary side of the ignition system must have at least 2 k Ω interference suppression.





- 1 = Spark gap
- 2 = 5 kΩ sleeve-type suppressor
- 3 = Ignition coil

 = Dangerous voltages (400 V - 25 kV)

- In order to prevent the trigger box from being irreparably damaged, when using a spark gap, an interference-suppression resistor of at least 2 kΩ must be connected between the spark gap and ignition coil terminal 4, e.g. sleeve-type suppressor (5 kΩ) 0 356 500 001.
- In the case of ignition distributors with engine-speed limitation the ignition distributor side terminal 4 must have 1 kΩ interference suppression. Operation without interference suppression will lead to the destruction of the trigger box.



- The holding springs of the distributor cap must not drop into the pickup system when the engine is being cranked and with the dust-protection cover removed.
- Do not disconnect the battery while the engine is running.
- Incorrect battery polarity will lead to the destruction of the trigger box and ignition coil.
- Do not use a starting aid with more than 16 V or a fast charger for starting.
- The specified ignition coil (see Part No.) must not be replaced with a different ignition coil.
- No suppression capacitor must be connected to ignition coil terminal 1 and terminal 15.
- Ignition coil terminal 1 must not be brought into contact with ground as a theft-proofing measure (ignition coil will be destroyed when ignition is switched on).
- Ignition cable from ignition coil terminal 4 to ignition distributor terminal 4 must not be disconnected during operation.
- The line between the inductive-type pick-up and the trigger box must be screened (otherwise negative effect on the trigger-box function).



9. Trouble-shooting program

Procedure

The trouble-shooting program is divided into 3 rows of boxes.

The left-hand row contains test instructions and test specifications.

The center row contains repair instructions.

The right-hand row contains the illustrations/terminal diagrams belonging to the text and the explanation of the items in the picture.

If the questions asked in the left-hand row can be answered conclusively with "Yes", then proceed to the next test down.

If the answer to the question is "No", branch to the center row and carry out the tests given there.

Before testing, make sure of the following:

Battery fully charged, fuel system O.K., engine mechanically O.K. (e.g. compression, valve clearance etc.). Ambient temperature/ignition system temperature 0° to +100 °C (temperature has a considerable effect on measured values).



Beginning of trouble-shooting program

Starting motor operates, engine fails to start or misfires or lacks power.

Yes

Continued on B 3

B2

Trouble-shooting program

BMW



yes ↓

Test primary voltage. If no oscilloscope or tachometer is available, check whether there is an ignition spark across the spark gap.

no →

If no primary voltage or no ignition spark, continue testing at C 1.

Testing as from B 5 not necessary.

Primary voltage with oscilloscope

Connect oscilloscope to ignition coil according to operating instructions. Start the engine. Oscilloscope must show a primary voltage (of any value).

Primary voltage with tachometer tester

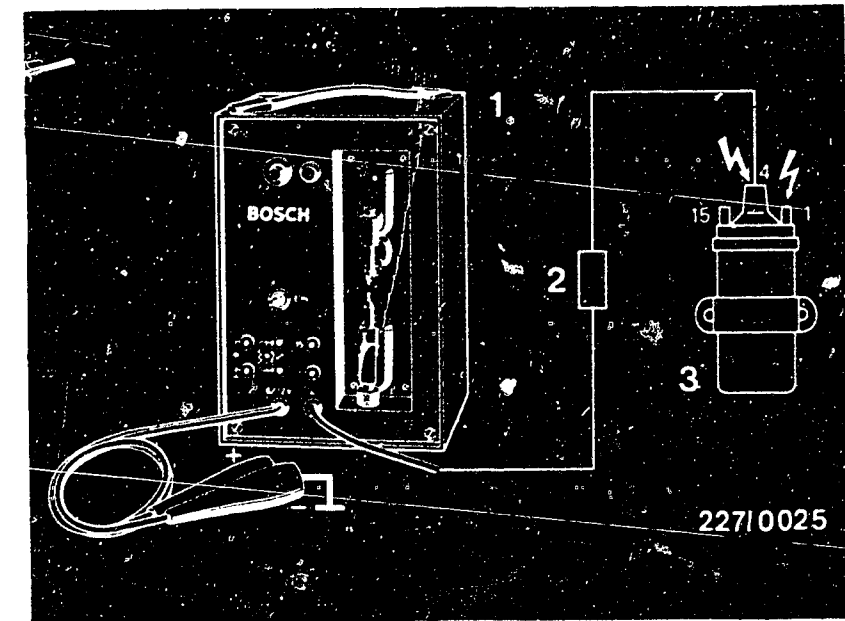
Connect tachometer tester to ignition coil according to instructions. Start the engine. Tachometer tester must indicate a value (any value).

Ignition spark with spark gap
Disconnect ignition cable 4 from ignition coil.
Connect the spark gap including sleeve-type suppressor (5 kΩ) to ignition coil. Adjust spark gap to 5 mm. Start the engine. There must be sparks across the spark gap.

Primary voltage on oscilloscope or ignition sparks across spark gap?

yes ↓

Continued on B5/6



- 1 = spark gap
- 2 = 5 kΩ sleeve-type suppressor
- 3 = ignition coil
- ⚡ = dangerous voltages

B3

Trouble-shooting program

BMW

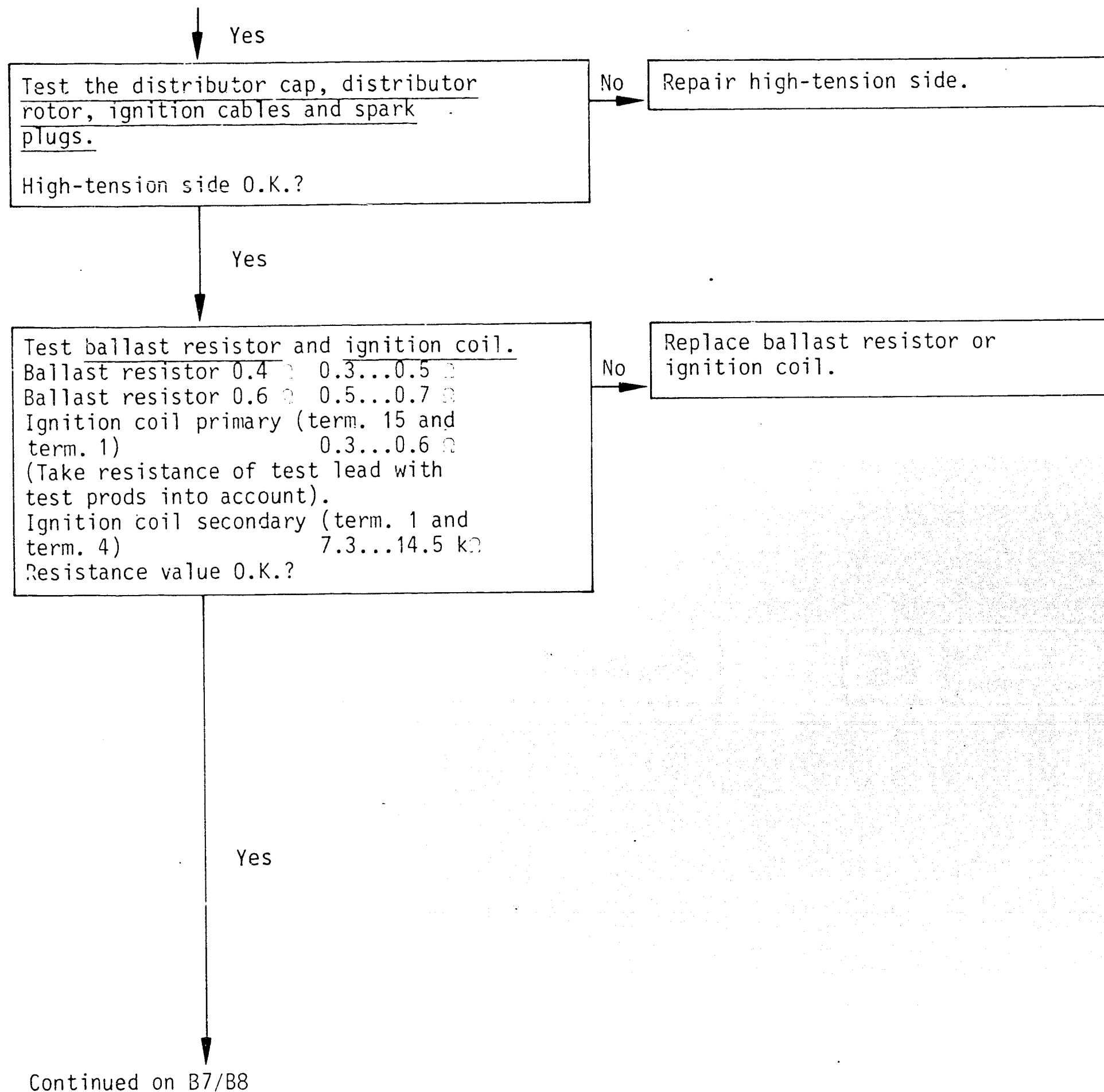


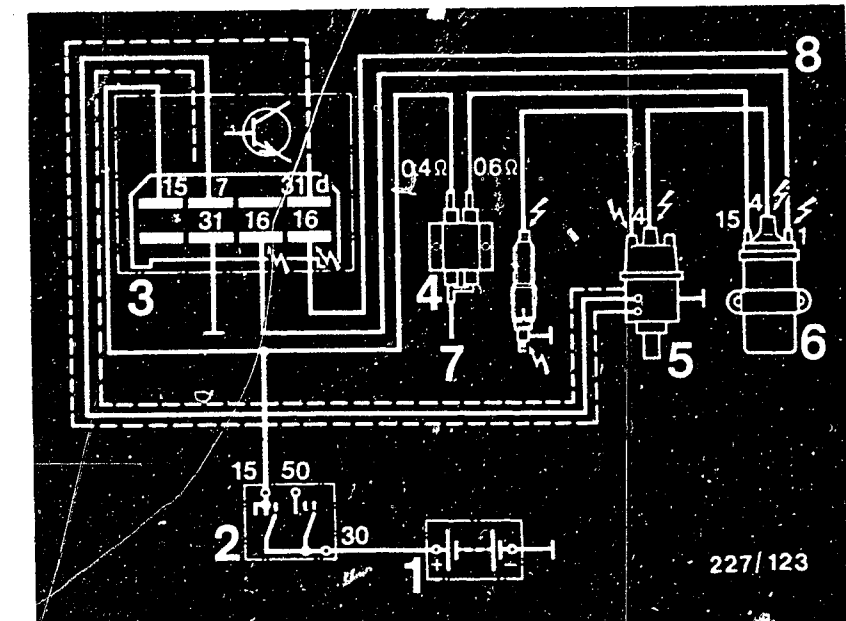
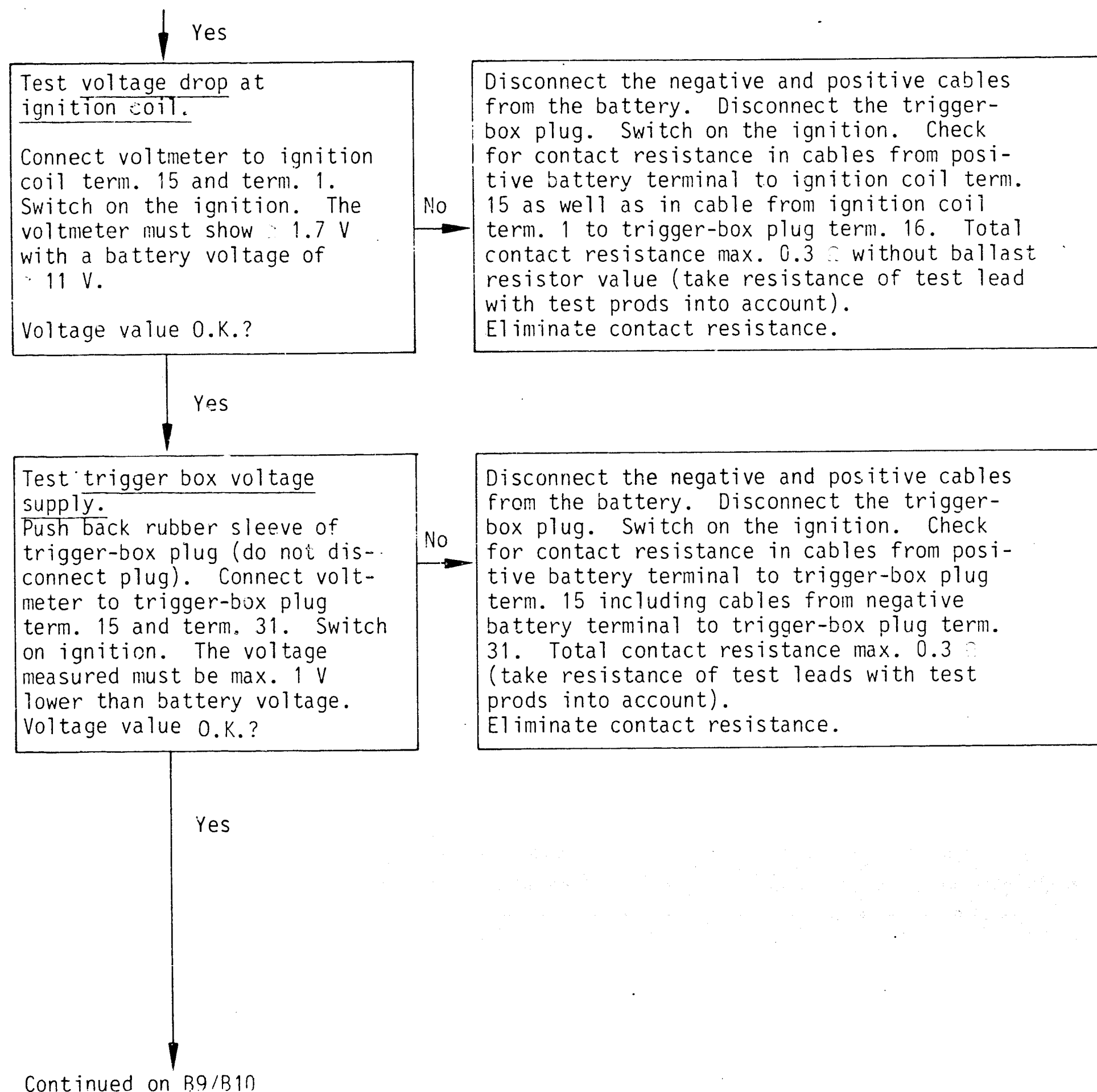
B4

Trouble-shooting program

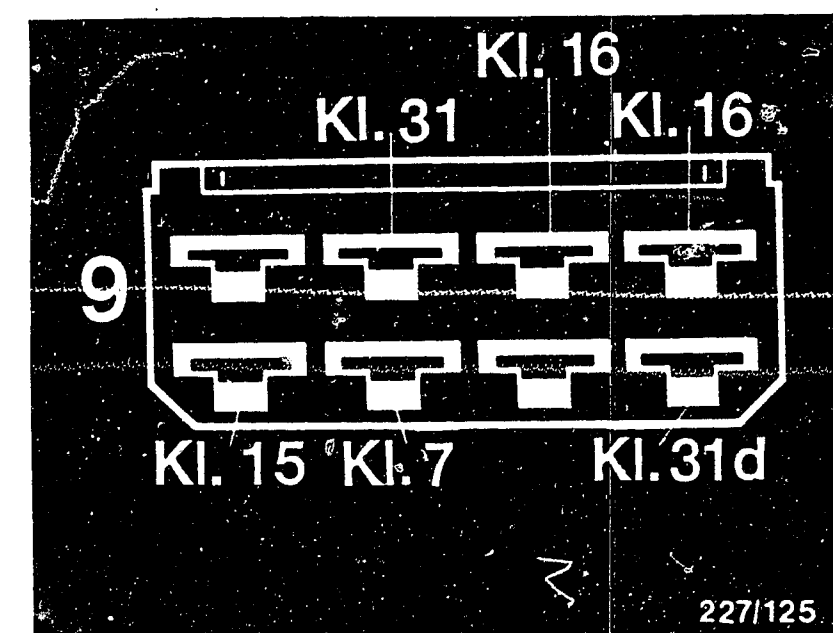
BMW

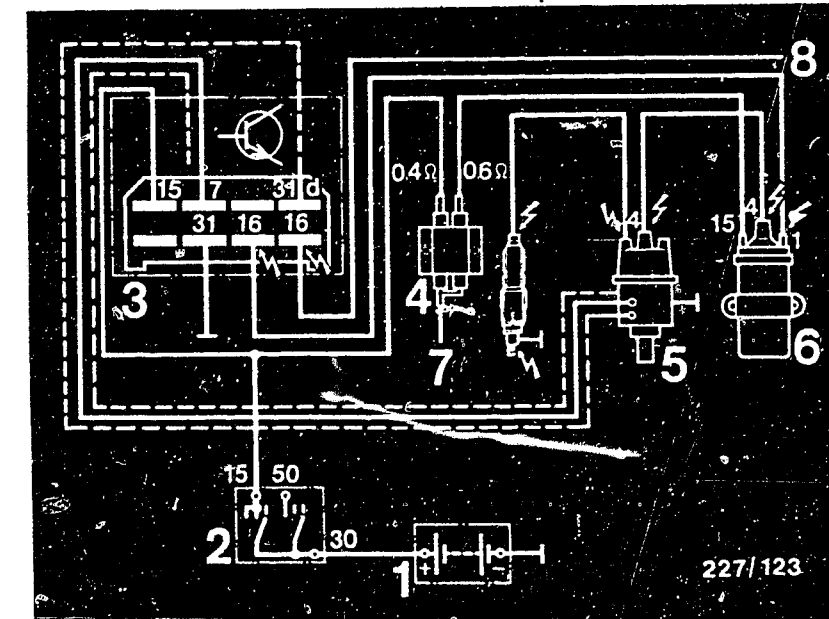
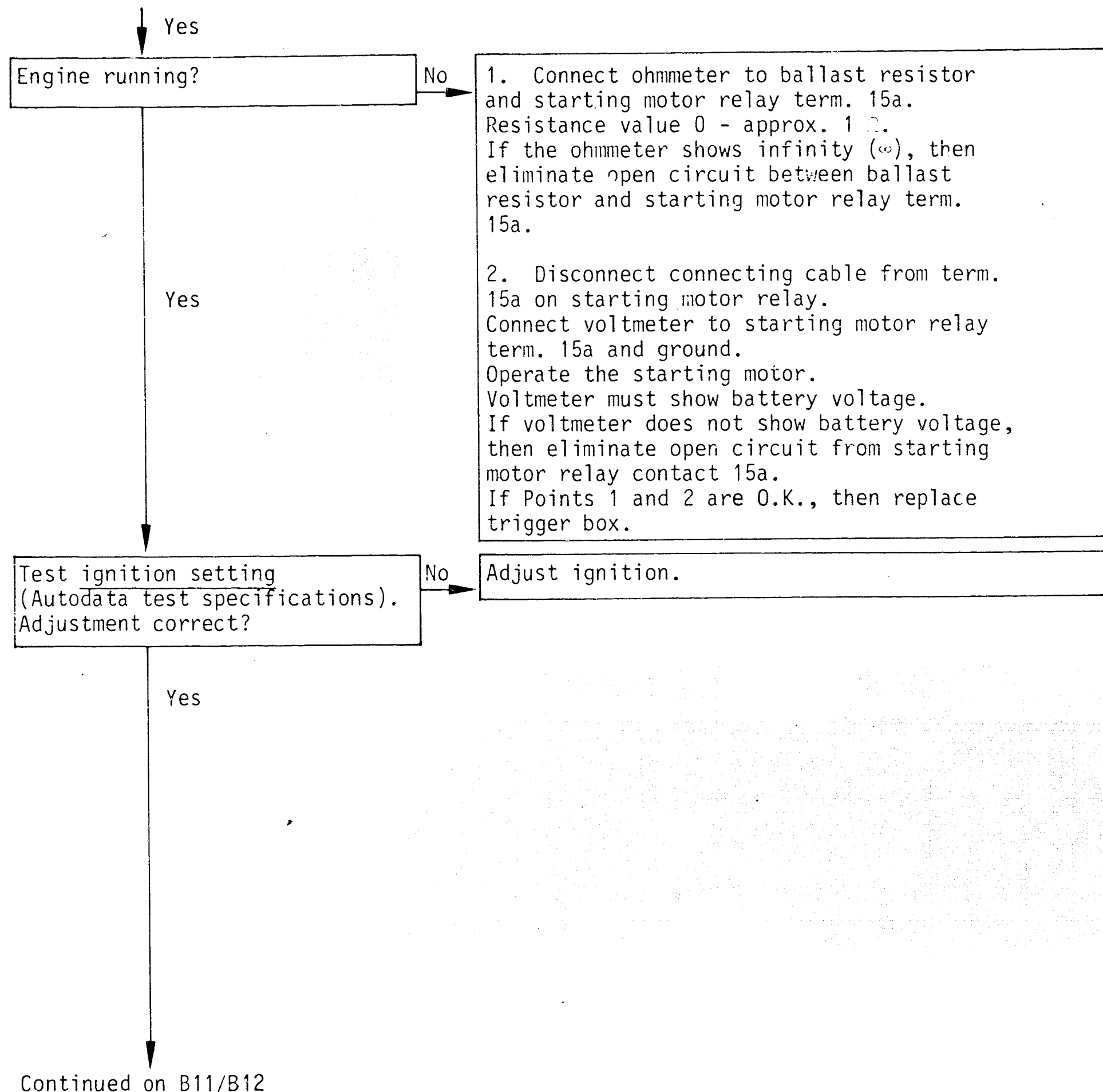






- 1 = Battery
- 2 = Ignition and starting switch
- 3 = Trigger box
- 4 = Ballast resistor
- 5 = Ignition distributor
- 6 = Ignition coil
- 7 = To starting motor term. 15a
- 8 = To L-Jetronic term. 1
- ⚡ = Dangerous voltages (400 V - 25 kV)
- 9 = Trigger-box plug





- 1 = Battery
- 2 = Ignition and starting switch
- 3 = Trigger box
- 4 = Ballast resistor
- 5 = Ignition distributor
- 6 = Ignition coil
- 7 = To starting motor term. 15a
- 8 = To L-Jetronic term. 1

⚡ = Dangerous voltages
(400 V - 25 kV)



Yes

Test dwell angle (only for a short period and with warm engine).

Connect the dwell-angle tester to the ignition coil according to the operating instructions.

Start the engine.

$n = 1500 + 50 \text{ min}^{-1}$

$33^\circ \dots 51^\circ (55 \dots 85\%)$

$n = 5000 + 50 \text{ min}^{-1}$

$45^\circ \dots 55^\circ (75 \dots 92\%)$

Dwell angle O.K.?

No

Yes

Continued on B13/B14

1. Test resistance of coil section including electric cable

Disconnect trigger-box plug.

Connect ohmmeter to the disconnected trigger-box plug between term. 7 and term. 31d.

Ohmmeter must show $485 \dots 850 \Omega$.

If resistance value is not O.K., then replace coil section/ignition distributor or electric cable.

2. Test the ground connection of the coil section and electric cable.

Connect the ohmmeter to the disconnected trigger-box plug at term. 7 or term. 31d and vehicle ground. The ohmmeter must show infinity (∞).

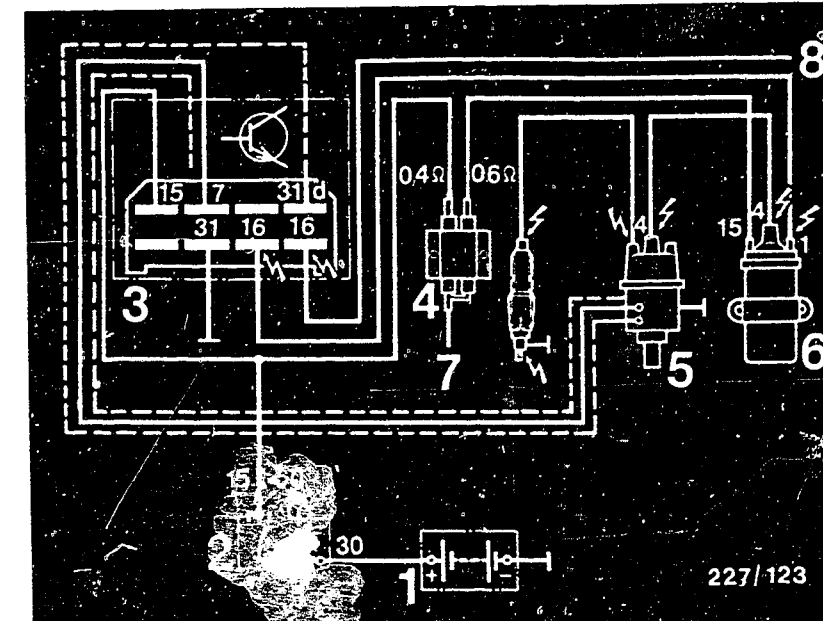
If resistance value is not O.K., then replace coil section/ignition distributor or electric cable.

3. Test pulse generator for mechanical damage.

Visual examination: Timer core must not rub against the teeth of the pulse generator.

If pulse generator is not O.K., then replace pulse generator/ignition distributor.

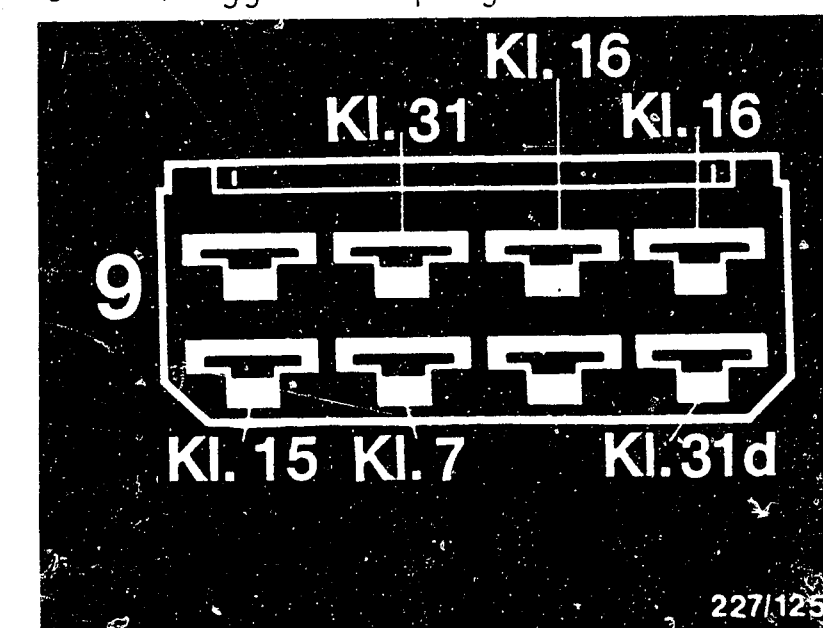
If Points 1 and 3 are O.K., then replace trigger box.



- 1 = Battery
- 2 = Ignition and starting switch
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- 4 = Ballast resistor
- 5 = Ignition distributor
- 6 = Ignition coil
- 7 = To starting motor term. 15a
- 8 = To L-Jetronic term. 1

= Dangerous voltages (400 V - 25 kV)

9 = Trigger-box plug



B11

Trouble-shooting program

BMW



B12

Trouble-shooting program

BMW



yes ↓

Test trigger box output stage.

Connect voltmeter to ignition coil terminal 1 and ground. Switch on ignition. The voltage measured must be max. 2 V.

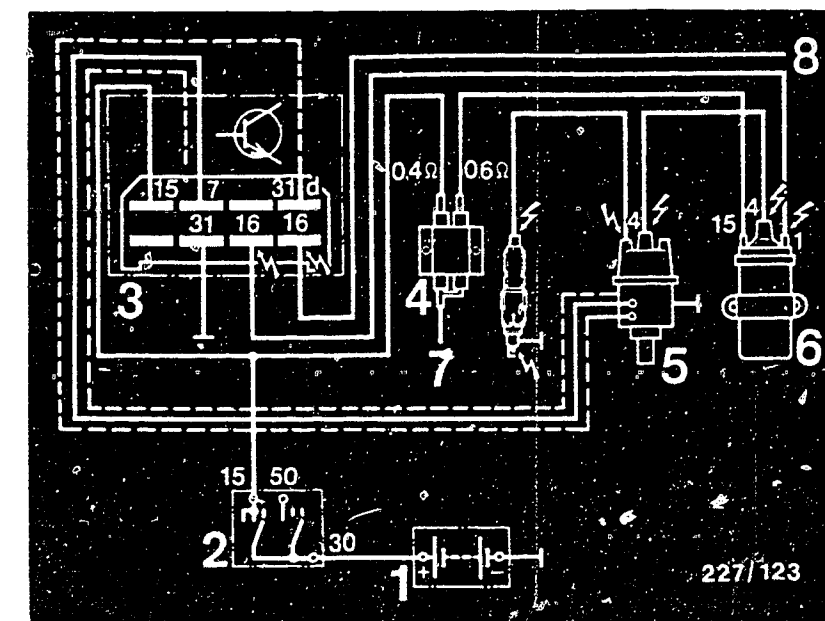
Voltage value O.K.?

no →

Replace trigger box

yes ↓

Continued on B15/16



- 1 = battery
- 2 = ignition and starting switch
- 3 = trigger box
- 4 = resistance cable
- 5 = ignition distributor
- 6 = ignition coil
- 7 = to starting motor term. 15a
- 8 = to tachometer
- ⚡ = dangerous voltages (400 V - 25 kV)

B 13

Trouble-shooting program

BMW



B 14

Trouble-shooting program

BMW



Yes

Test the primary voltage (if MOT series available).
Connect oscilloscope (e.g. MOT 201) to ignition coil according to operating instructions.
Run engine at idle.
The primary voltage measured must be 100...180 V. See diagram.
Voltage value O.K.?

No

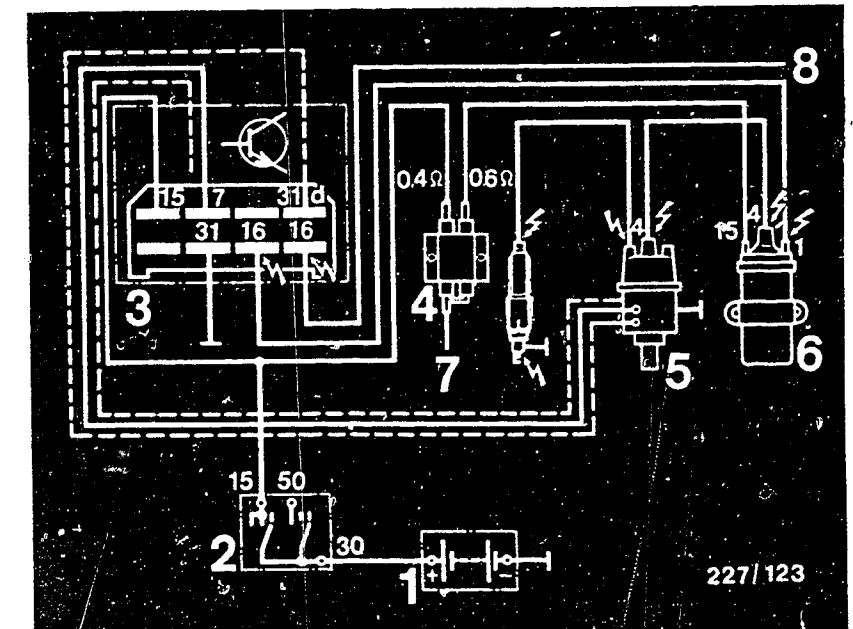
Replace trigger box.

Yes

Ignition system O.K.
Test completed
Tests as from C 1 no longer necessary.

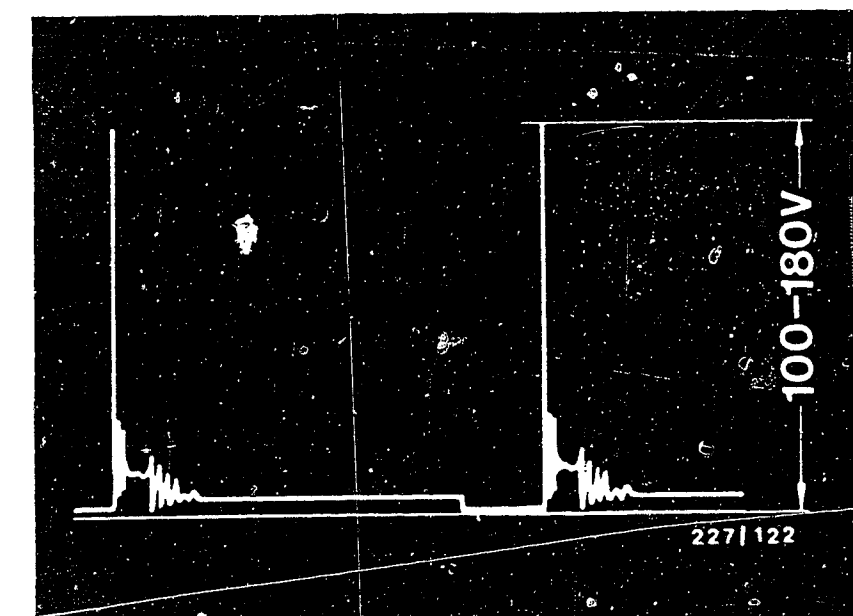
Please note:

If the cause of the customer's problem is not eliminated, then there are further faults in the fuel system or the engine is not mechanically O.K.



- 1 = Battery
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- 3 = Trigger box
- 4 = Ballast resistor
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- 8 = To L-Jetronic term. 1

⚡ = Dangerous voltages
400 V - 25 kV)



B 15

Trouble-shooting program

BMW



B 16

Trouble-shooting program

BMW



No primary signal or no
ignition spark
(continued from B 3)

Yes

Test resistance of coil section
including electric cable.
Disconnect trigger-box plug.
Connect ohmmeter to disconnected
trigger-box plug between term. 7
and term. 31d.
Ohmmeter must show 485...850 Ω .
Resistance value O.K.?

No

Replace coil section/ignition
distributor or electric cable.

Yes

Test ground connection of coil
section and electric cable.
Connect ohmmeter to disconnected
trigger-box plug at term. 7 or
term. 31d and vehicle ground.
Ohmmeter must show infinity (∞).
Resistance value (∞) O.K.?

No

Replace coil section/ignition
distributor or electric cable.

Yes

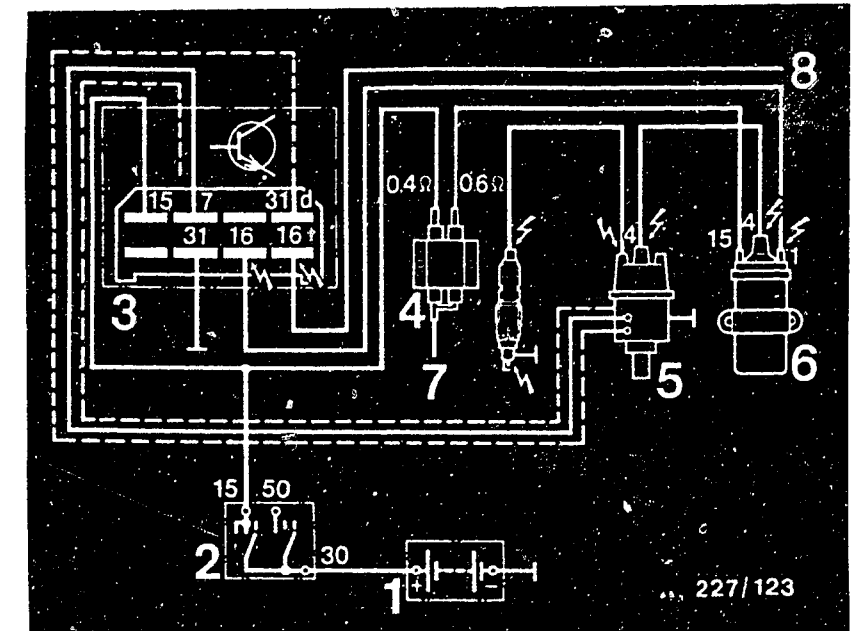
Test pulse generator for mechanical
damage.
Visual examination: Timer core
must not rub against the teeth of
the pulse generator. Pulse gener-
ator O.K.?

No

Replace pulse generator/
ignition distributor.

Yes

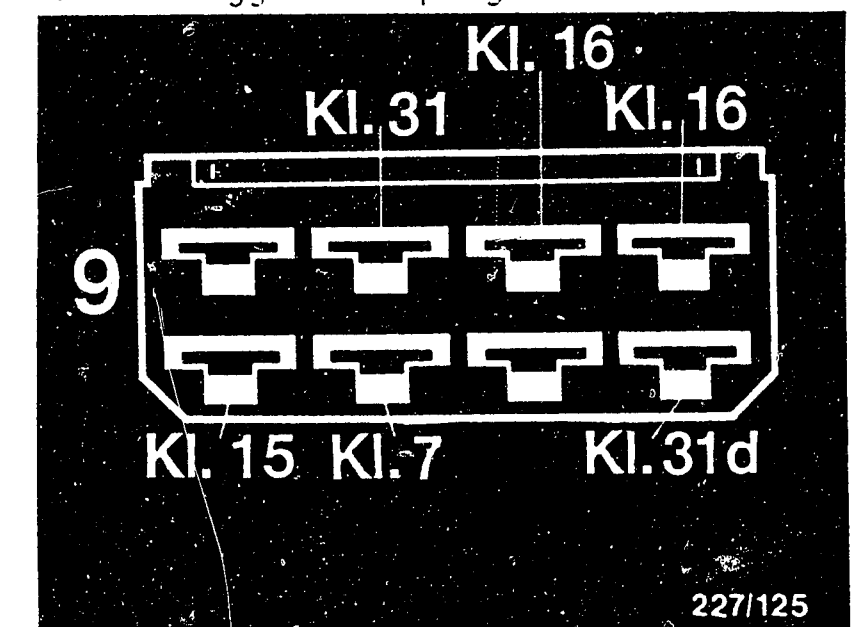
Continued on C3/C4



- 1 = Battery
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⚡ = Dangerous voltages
(400 V - 25 kV)

9 = Trigger-box plug



C1

Trouble-shooting program

BMW

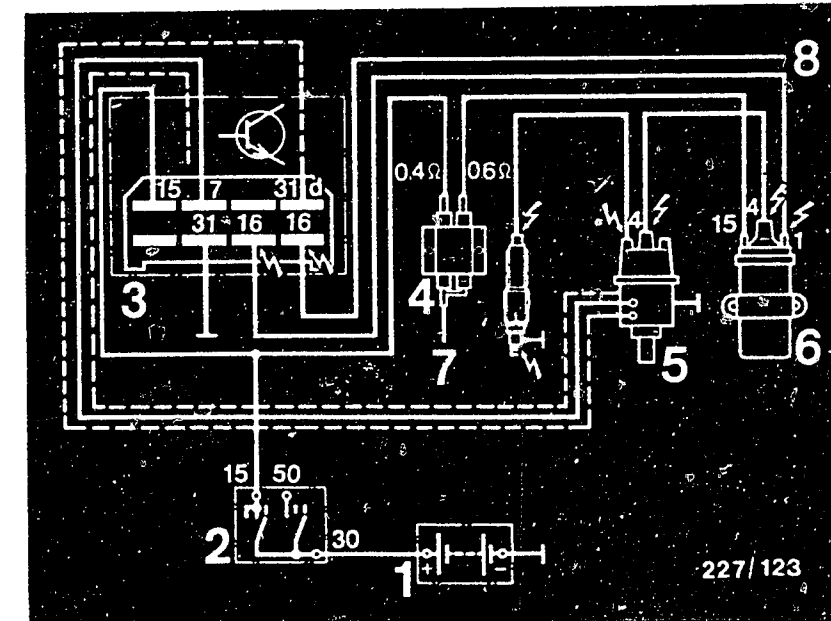
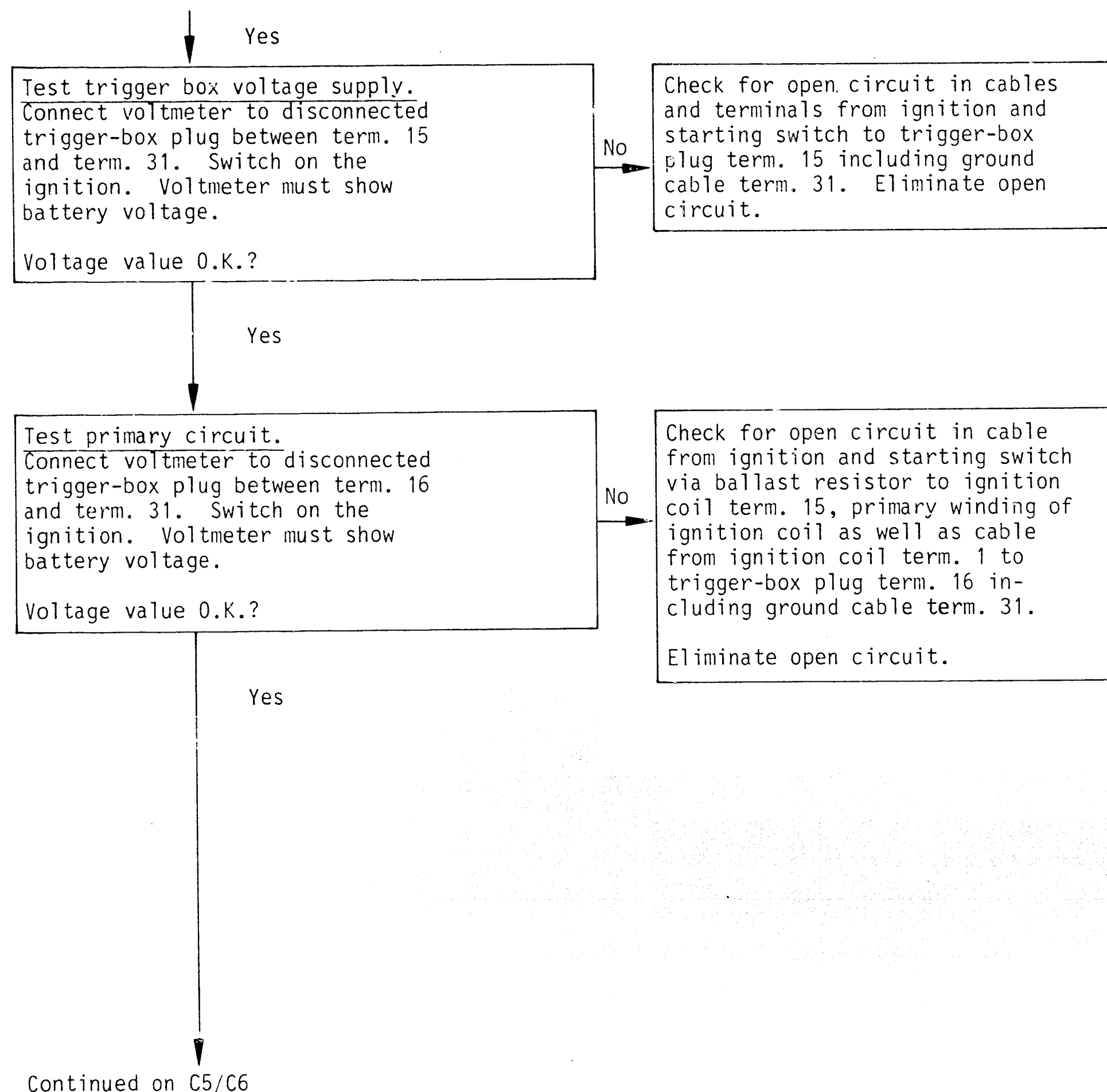


C2

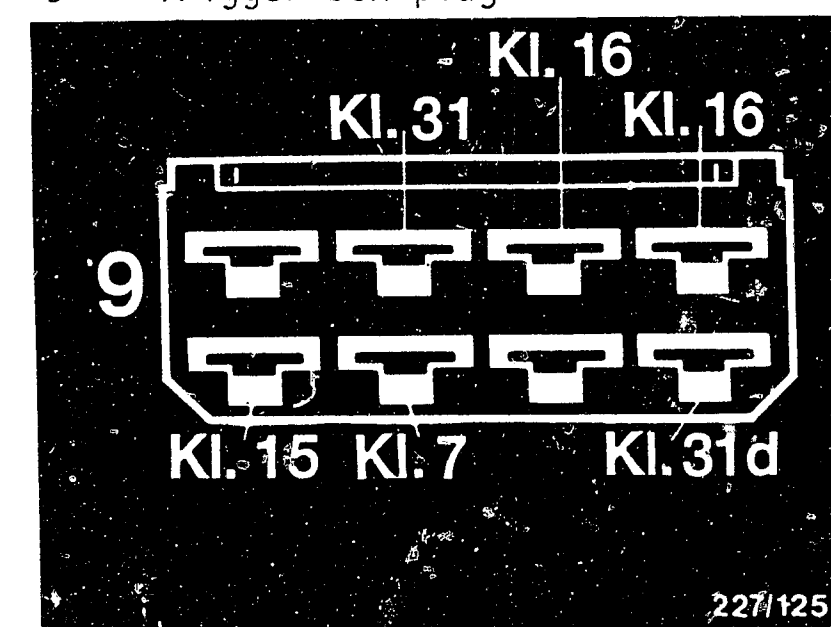
Trouble-shooting program

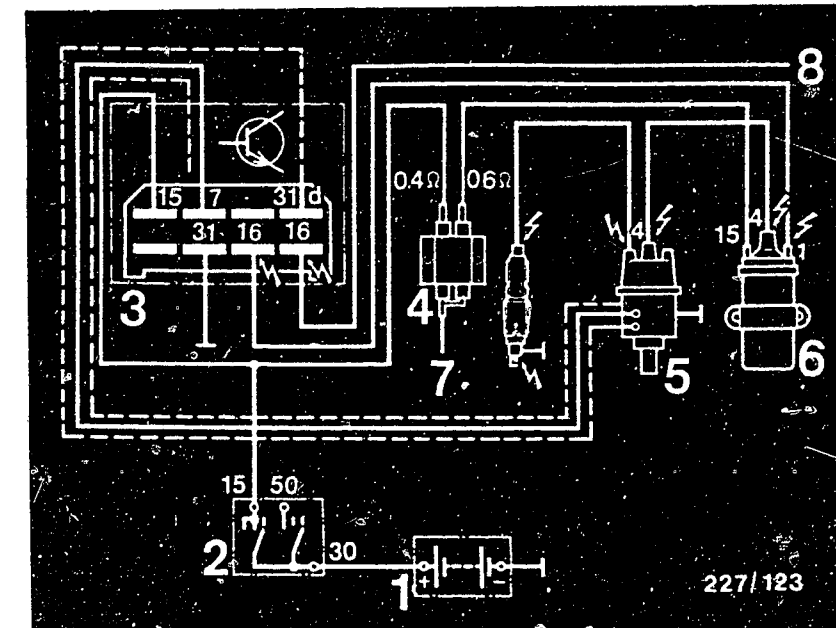
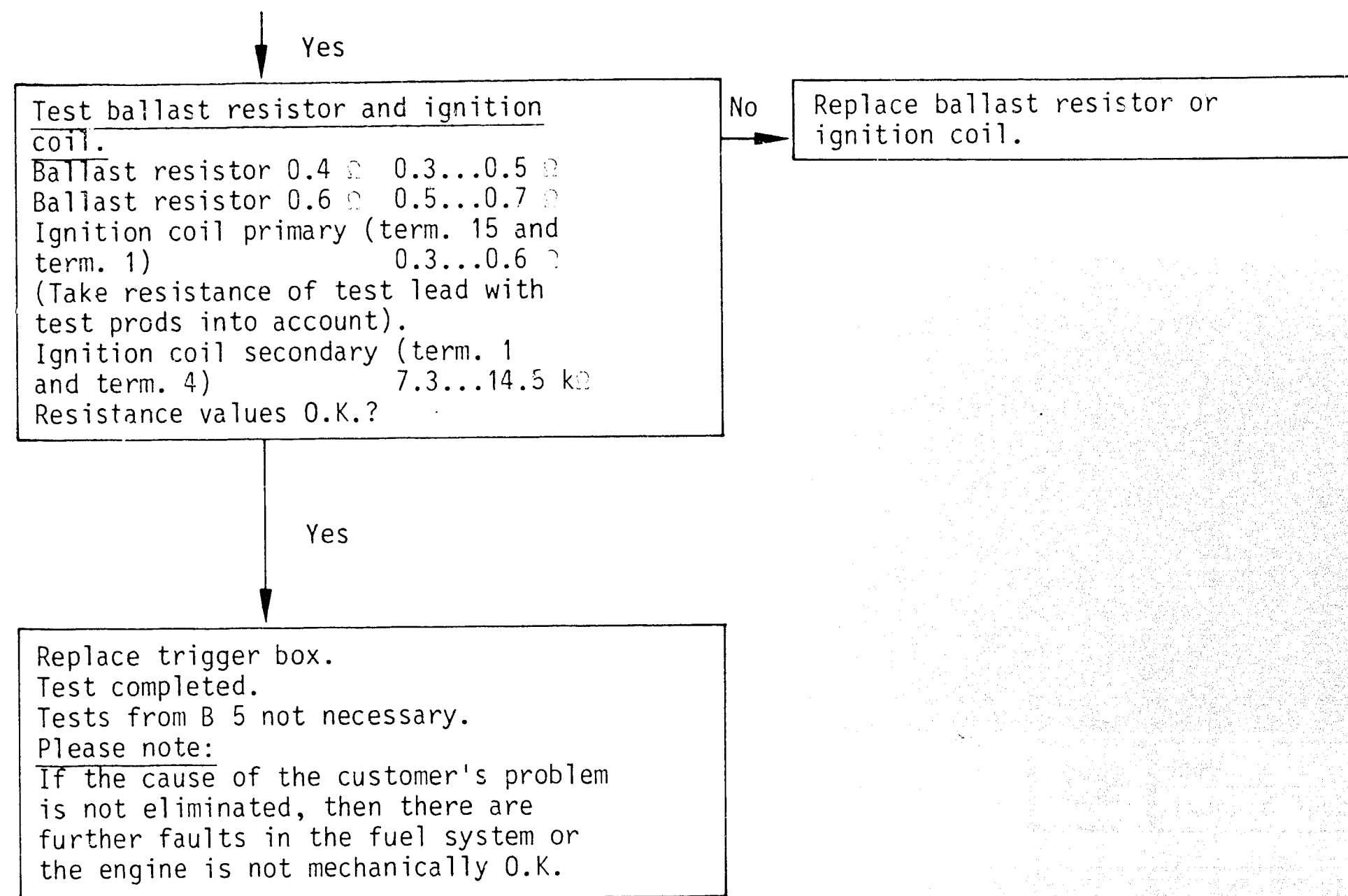
BMW





- 1 = Battery
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After-sales Service

Technical Bulletin

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22

Danger of Accident on Semi-conductor Ignition Systems

VDT-I-227/102 B

11.1976

Please be sure to pass this bulletin on to your employees for their attention.

The increased demands made on their ignition systems by modern engines, and the wish for freedom from maintenance, led some time ago to manufactures starting to equip their vehicles with semi-conductor ignition systems as original equipment. In most cases the performance of nearly all makes of such systems is higher than that of conventional systems, and further improvements are to be expected. This means that semi-conductor ignition systems have reached the point where contact with "live" parts or contacts (whether on the primary side or the secondary side) can prove fatal.

In this connection we should like to point out to you that the laws valid in your country regarding work on high-voltage systems must be adhered to when working on, or testing, semi-conductor ignition systems.

As a matter of principle, when working on such ignition systems the ignition is to be switched off. Included in such work are the following operations:

- Connection of engine testing equipment (timing light, dwell-tach tester, ignition oscilloscope etc.).
- Replacement of ignition system parts (spark plugs, ignition coil, ignition distributor, H.T. ignition cables etc.).

If it is necessary to switch on the ignition in order to test the system or make adjustments on the engine (to the carburetor for instance), then lethal voltages are present throughout the entire system.

This means that the danger of accident exists not only at individual components in the system (e.g. ignition distributor, ignition coil, trigger box, ignition harness), but also at the wiring harness (e.g. connection for the tachometer, diagnostic connector), on terminals, and on test equipment.

BOSCH

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L1

Technical Bulletin

BMW

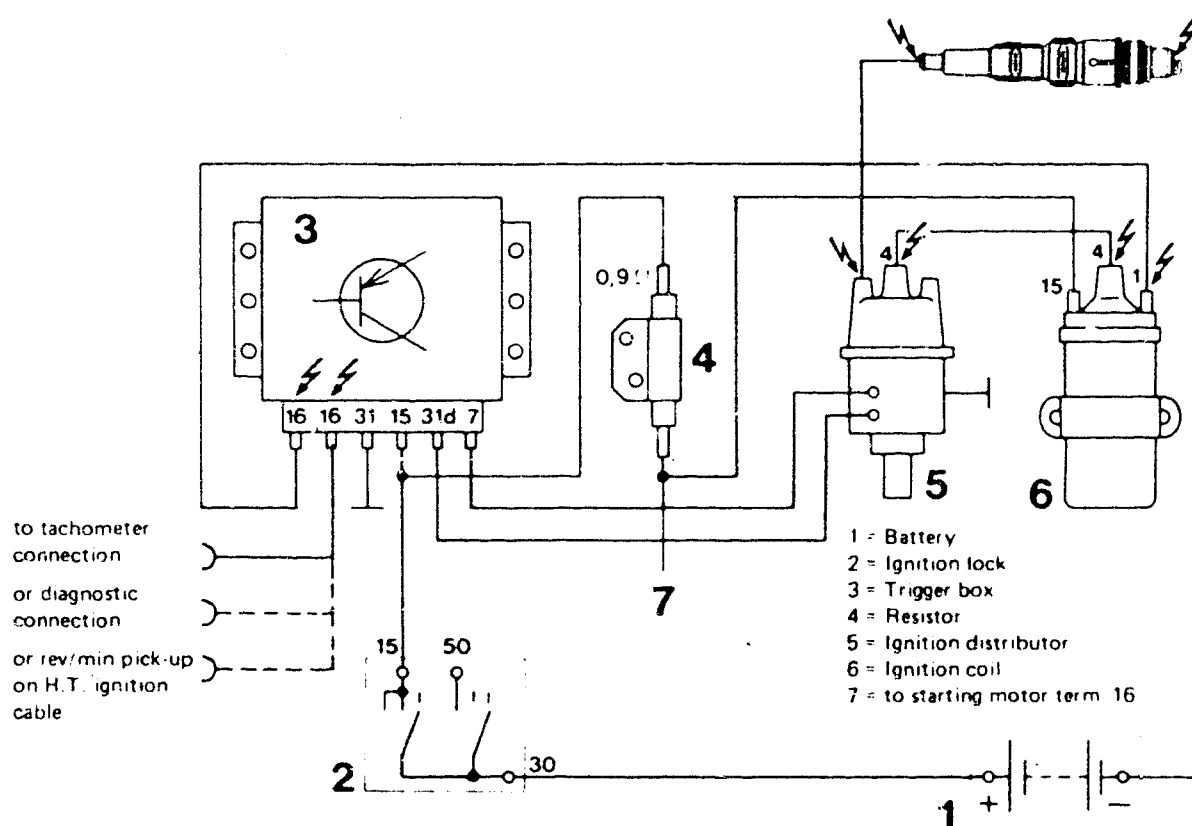


In addition, in the case of the capacitor-discharge ignition system (CDI), danger of accident is also present under the following circumstances:

- Operation of the trigger box without the ignition transformer.
- At the trigger box, (removed), relatively soon after it has been switched off (capacitor discharge).

Below is a typical terminal diagram of a semi-conductor ignition system, the danger points are marked with red high-voltage arrows. We would point out that all semi-conductor ignition systems, even the older ones, are to be regarded as dangerous in the sense as defined by this bulletin.

Please address any queries or comments concerning the contents of this publication to our representative in your country.



Terminal diagram



After-sales Service

Technical Bulletin

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EFFECTS OF ELECTRICAL AND ELECTRONIC

VDT-I-227/107 En

SYSTEMS ON HEART PACEMAKERS

1.1981

e.g. ignition systems, Jetronic, Motronic, ABS

Please ensure without fail that this Bulletin is passed on to your employees for their attention!

We have often been asked by some of our customers whether or not patients with heart pacemakers are endangered in any way by ignition systems. This theme was recently the subject of an examination carried out by the Ignition System Development Department of Robert Bosch GmbH in conjunction with Dr. Thull, lecturer at the Central Institute for Biomedical Technology at the University of Erlangen-Nürnberg and Biotronic GmbH & Co. of Berlin, a manufacturer of heart pacemakers. The magazine "Biomedizinischen Technik" (5/80) listed the results.

The most important discoveries in this practice can be summarized from the examination report as follows:-

1. Heart pacemakers corresponding to the latest state of the art are not affected by radiation (electromagnetic fields) from ignition systems.
2. With a stationary engine and the ignition switched off the heart pacemaker is not affected by any part of the ignition system, even when unintentionally touched. Maintenance work in the engine compartment, for example, can then be carried out without any danger.
3. With the engine running or stationary with the ignition switched on, touching current-carrying parts of the ignition system, as well as parts of any other electrical system, presents a certain danger for everybody. The heart pacemaker can here be affected under certain conditions (voltage, current and frequency).
Patients with heart pacemakers should therefore at all costs avoid touching current-carrying parts of electrical systems.
4. Furthermore, patients with heart pacemakers are more inclined to psychic shock effects than other people, even when they receive just a harmless electric shock, because many such patients are conscious of the increased danger to the cardiac activity.

We therefore consider it inadvisable for patients with heart pacemakers to be employed in workshops or on vehicles where ignition systems are being tested or repaired. If any members of your staff have heart pacemakers please carry out the necessary measures.

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We would like to add that heart pacemakers are not expected to be affected in any way by interference from other electronic products and systems which we manufacture, such as the Antiskid System (ABS), Jetronic, Motronic, because the much greater radiation intensity of the ignition systems examined in normal use has not caused any interference to heart pacemakers corresponding to the latest state of the art.

If you should receive questions on this matter from customers, please inform them accordingly.



After-sales Service

Technical Bulletin

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NEW DESIGNATIONS FOR IGNITION SYSTEMS

VDT-I-227/108 En

5.1981

The introduction of new ignition systems has made it necessary to reclassify all designations.
The designations listed below will be used immediately in KH workshops and in sales literature.

Designation	Abbreviated code	Meaning	Switching part	Ignition control and spark advance	High-voltage distribution
Coil ignition	SZ (CI)	-----	mechanical (breaker points)	mechanical (ignition distributor)	mechanical (ignition distributor)
Transistorized coil ignition	TSZ-k (TCI-c)	k=breaker-triggered	electronic (trigger box)	mechanical (ignition distributor)	mechanical (ignition distributor)
Trigger box with traditional switching techniques	TSZ-I* (TCI-i)	I=induction type pulse generator	electronic (trigger box)	mechanical (ignition distributor)	mechanical (ignition distributor)
	TSZ-H (TCI-h)	H=Hall generator	electronic (trigger box)	mechanical (ignition distributor)	mechanical (ignition distributor)
Transistorized ignition	TZ-I* (TI-i)	I=induction type pulse generator	electronic (trigger box)	mechanical (ignition distributor)	mechanical (ignition distributor)
(Trigger box in hybrid technique)	TZ-H* (TI-h)	H=Hall generator	electronic (trigger box)	mechanical (ignition distributor)	mechanical (ignition distributor)

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Designation	Abbreviated code	Meaning	Switching part	Ignition control and spark advance	High-voltage distribution
Electronic ignition	EZ-L	L=characteristic curve	electronic (trigger box or control unit)	electronic (control unit)	mechanical (ignition distributor)
	EZ-F	F=ignition map	electronic (trigger box or control unit)	electronic (control unit)	mechanical (high-voltage distributor)
Distributorless semiconductor ignition	VZ-L	L=characteristic curve	electronic (control unit)	electronic (control unit)	electronic (two-spark ignition coil, or 1 ignition coil/spark plug)
	VZ-F	F=ignition map	electronic (control unit)	electronic (control unit)	electronic (two-spark ignition coil, or 1 ignition coil/spark plug)

* Please note: The ignition system can additionally be fitted with a DLS unit (digital idle stabilizer) or with an ELS unit (electronic idle stabilizer) or with an ESV unit (electronic ignition retardation).



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Motor Vehicle Service Information

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TESTS ON ELECTRONIC IGNITION SYSTEMS
(TCI, T2)
TESTER INSTRUCTIONS

VDT-I-Gen. 035 En
3.1981

The following tests are listed in older and current Tester operating instructions or in Trouble-shooting with the oscillograph.:

- "Separate ignition coil test" (concerns EFAW 213, 214, 268, AE 2000).
- Calculating the "ignition voltage reserve" (concerns EFAW 213, 214, 268, AE 2000 and MOT series).
- "Intensified insulation test" (concerns EFAW 213, 214, 268, AE 2000 and MOT series).

Nowadays transistorized ignition systems deliver more than 30,000 V secondary voltage.

To avoid damage to ignition coil, ignition cable and ignition distributor by voltage flashovers, the tests listed above should not be carried out on transistorized ignition systems.

The contents of this Service Information has already been published in the K7-Information K7-VJF 17/8012.

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